

WHAT IS CLAIMED IS

5

1. A method for fabricating a semiconductor device, comprising the steps of:

forming a barrier conductor layer on a substrate;

10 exposing said barrier conductor layer to a  
first reducing gas atmosphere at an elevated  
substrate temperature;

forming, after said step of exposing said barrier conductor layer to said first reducing gas atmosphere, a metal film on said barrier conductor layer by a CVD process; and

exposing said metal film to a second  
reducing gas atmosphere at an elevated substrate  
temperature.

20

2. A method as claimed in claim 1, wherein  
25 said first reducing gas atmosphere is selected from  
any of the group consisting of silane, ammonia and  
hydrogen.

30

3. A method as claimed in claim 1, wherein  
said step of exposing said barrier conductor layer to

said first reducing gas atmosphere is conducted at a temperature of 250 - 500°C.

5

Sub A 4. A method as claimed in claim 1, wherein said second reducing gas atmosphere is selected from any or more of hydrogen and nitrogen.

10

Sub B 5. A method as claimed in claim 1, wherein said step of exposing said metal film to said second reducing gas atmosphere is conducted at a temperature of 250 - 500°C.

20

6. A method as claimed in claim 1, wherein said metal film is a Cu film.

25

7. A method as claimed in claim 1, wherein said barrier conductor layer is formed of any of Ta or TaN.

30

8. A method of fabricating a semiconductor device, comprising the steps of:

forming a barrier conductor layer of any of tungsten nitride or tantalum nitride on a substrate;

5 exposing said barrier conductor layer to a plasma of a reducing gas at an elevated temperature; and

forming, after said step of exposing said barrier conductor layer to said plasma, a metal film  
10 on said barrier conductor layer by a CVD process.

15 9. A method as claimed in claim 8, wherein said reducing gas is hydrogen.

20 10. A method as claimed in claim 8, wherein said step of exposing said barrier conductor layer to said plasma is conducted at a temperature of 50 - 400°C.

25

<sup>sub</sup>B11 > 11. A method as claimed in claim 8, further  
30 comprising, after said step of forming said metal film, a thermal annealing process applied to said metal film in a reducing gas atmosphere.

12. A method as claimed in claim 11,  
wherein said thermal annealing process is conducted  
at a temperature of 250 - 500°C.

5

13. A method as claimed in claim 8, wherein  
said metal film is formed of Cu.

10

14. A method of fabricating a semiconductor  
15 device, comprising the steps of:  
alternately and repeatedly forming, on a  
substrate, an insulating film, a barrier conductor  
layer of any of tungsten nitride and tantalum nitride,  
and a metal film, said metal film being formed by a  
20 CVD process,

wherein a step of exposing said barrier  
conductor film to a plasma of a reducing gas at an  
elevated temperature is interposed between said step  
of forming said barrier conductor layer and said step  
25 of forming said metal film.

Add A31